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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/619,613

07/16/2003

Moo Ho Bae

240366US2

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12/09/2010

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EXAMINER

JAWORSKI, FRANCIS J

ART UNIT

PAPER NUMBER

3768

NOTIFICATION DATE

DELIVERY MODE

12/09/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/619,613	Applicant(s) BAE, MOO HO	
	Examiner FRANCIS JAWORSKI	Art Unit 3768	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 September 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3 - 6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6 is/are allowed.
- 6) ☒ Claim(s) 1,3 - 5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

[Parenthesized claim numbers identify the specific claim or claims being addressed by the immediately preceding rejection argument].

Claims 1, 3, 5 as amended are rejected under 35 U.S.C. 102(b) as anticipated by or in the alternative as being unpatentable over Barabash et al (US6138513).

Barabash et al note that in the course of delay focusing the S/N improvement is preserved if channel measurements are independent and this may be preserved by time-multiplexing the channel contributions, see cols. 3 – 4 bridging and col. 6 lines 31 - 37. On the receive side, analog switches 23 are used in each of Figs. 3a – 3d and col. 6 lines 58 – 63 makes clear that the analog switches when present are present to reduce (i.e. time serialize) the number of channels prior to A/D conversion and digital

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focusing operations for example in a high-throughput processor, see col. 10 lines 59 - 64. However where there is a single processing channel for example Fig. 3.a the information is accepted into a single channel path by time-multiplexing all elements i.e. 'at least two' via the analog switches thereby producing 'said multiplexed signal' (singular) on the output of main amplifier 24, see col. 7 lines 22 - 34. Digital focusing is then performed by a synthetic aperture process per cols. 7 - 8 bridging.

In the alternative, col. 6 lines 31 - 37 suggests a parallel processing scheme may arise in which for high throughput the signal processing is paralleled in 4 - 8 output channels per Fig. 3.b and in this parallel processing instance e.g. for 3-D image processing it is argued that an obvious variant would be to use analog multiplexing switches to reduce an initial reasonable number of transducer element channels to a single one of the output paths of 24 for digital focus operations. (Claim 1).

Otherwise both time shifting and interpolation occur in the beamformer process as well as amplitude filtering in terms of application of apodization shading functions per cols. 7 - 8. (Claim 3).

The parallel channels which include the one or more exclusively multiplex-selected channels effectively provide a parallel processing which forms multiple beams of reception within the broad transmission beam for Fig. 3.b. (Claim 5).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barabash et al as applied to claim 1 above, and further in view of Freeman (US6208189, of record) since the latter teaches that an ASIC-based architecture for an ultrasound

system as in Barabash et al permits easy component interconnections and high speed processing as desired in the former. (Claim 4).

Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Dietrich (US5520186, of record on the PTO-892 of May 4, 2007).

Dietrich modifies the conventional beamforming system of Figs. 1 – 2 by installing a bank of analog switches incorporated into multiplexer integrated circuits, see Fig. 3 and its discussion, in order that the system having say 128 channels can accommodate for example a 192 element probe. Hence in Dietrich the apparatus may be described as including a digital-receive focussing beamformer portion having a plurality of channel modules 34 responsive to 192 ultrasound channels and configured to produce a focused beam, where i) a sub-plurality therefore yet a ‘plurality’ of these channels include a 2:1 analog multiplexer to multiplex ultrasound signals originating from at least two ultrasound channels, see col. 4 line 62 – col. 5 line 2 and col. 5 lines 43 – 46., and ii) the beamformer is coupled to the analog multiplexer for digitally processing....’said multiplexed signal’ to produce the receive-focussed beam.

Dietrich is deficient as a teaching of applicant’s core invention in that since the analog multiplexer is accomplishing a ‘neckdown’ of more ultrasound channels than processing channels as different types of probes are encountered, the 2:1 reduction is either/or per col. 5 lines 14 – 22, in order that only 128 of the 192 transducer input connect exclusively in 1:1 fashion to the beamformer. While this is distinct from time-multiplexing of plural ultrasound channels onto a single beamformer input channel, such a distinction is immaterial to the language of claim 1 which requires only that an analog

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multiplexer multiplex e.g. from two respective channels for example onto one * channel and thereafter 'said multiplexed ultrasound signal' is digitally processed to eventually produce a focused beam.

[* Applicant's language supports for example a 4:2 process yielding an intermediate channel which possibly itself includes constituent signals further processed in cascade or a 4:1 process, however the 2:1 interpretation is pursued to in order to explain the basic argument rationale.]

Within the beamformer stage 36, 38 the equalization stage would otherwise compensate for individual channel variations during the receive-focus process and/or the per-channel filter, see col. 2 lines 42 – 44. In other words the equalization is believed to act on the composited beamsummed scanline with respect to others of the set whereas the filter acts on individual channels immediately before they are beamsummed into the scanline and either or both are a compensatory process. (Claim 1).

Dietrich col. 2 lines 41 – 51 are tantamount to revelation of an analog-to-digital converter stage prior to the focus and equalization. As noted above, filtering is practiced for each channel. Time delay is intrinsic to the beamsummation process since it uses delay to reconstitute information from a given echo focal depth and direction. (Claim 3).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dietrich as applied to claim 1 above, and further in view of Freeman (US6208189) since as earlier noted Freeman evidenced that an ASIC architecture is suitable for implementing a beamformer including analog multiplexers 14 in order to provide flexibility in board

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connections which is a desideratum in Dietrich who was using multiplexer integrated circuits earlier in this art. (Claim 4).

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over either a) Dietrich as applied to claim 1 above, and further in view of Odell (US5268877) or b) Barabash et al in view of Odell.

Odell is representative of an origin of parallel multi-beam formation which derived from the sonar art as have many medical adaptations, see col. 1 lines 10 – 20. Odell effectively defines a scalability by which information returning from a multiplicity of transducers (hydrophone being the sonar equivalent of an imaging transducer) can be processed as partial beamsums on a beamformer chip 30 of Fig. 3 to provide a partial beamsum 31 which feeds a summation node 38, likenable to applicant's Figure 1 either 37a or 37b or 39 or 41 in the sense that the Odell beamformer chip contributions may further cascade into higher level partial summations, see Figure 3 "(Partial)" legend on right.

Applicant's claim 5 language therefore may reasonably refer to either the initial stage including elements 27 – 29 (portions of which analog-switch dual incoming beams in time-division-multiplexing onto a common channel to reduce the A/D converter numbers required) and so act as a surrogate or 'first stage 2:1 partial beamformer' broadly akin to Odell's conventional digital stage 30 and with sum 36 akin to 38, or may refer to the overall channel subset pairs e.g. 21a and 21 b which sum as 37 then akin to 38 or as a further cascade of overall channel 21a – 21d sum then 39 being akin to Odell 38 or may refer to a further cascade of overall sums with 41 akin to the Odell Fig. 3

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inference that the entire output of partial overall sums 30 is proceeding to other nodes of partial summation at a higher level yet.

a) Since Dietrich had migrated to multiple channel beamformer throughput in order to quickly process the image, it would have been obvious in view of Odell to parallel process multi-channel ultrasound information in order to increase throughput rate and provide scalability and scaling for larger transducer numbers which are desiderata in the former. Another way of stating the argument is that parallel beamformation is per se an old technique and nothing in the claim language specifically defines the surrogate or 'channel pre-digestion' case (Examiner's language coinage).

b) In the alternative, since Barabash et al is concerned with scalability in fast acquisition from an increased number of channels it would have been obvious to practice conventional multi-channel multi-beam summation as per Odell in light of the latter's preferring of the technique as suitable for handling large numbers of transducers with a scaled architecture. (Claim 5)

Allowable Subject Matter

Claim 6 is allowed.

Response to Amendment

Against the amended claims which now include that the analog multiplex signal result is processed to produce the receive-focus beam the examiner is posing that both Barabash and Deitrich provide analog multiplexing to beamformer architectures which

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then provide receive focus to the multiplex signal output, and/or in conjunction with conventional digital multiple beam summation.

To the extent that arguments in the amendment filed 9/13/2010 carry forward, the Examiner is holding that multiplexers may route as well as sequentially combine signals onto a single path which may be a combined path as in Barabash et al or a unique path as in Dietrich.

Accordingly while the Examiner has allowed claim 6 directed to the applicant's improved architecture, the broadest permissible claim language remains elusive.

Alexandru (US7508737, of ineffective date) is cited to complete the record and perhaps assist applicant by coming at this relatively difficult problem using a different type of 'channel pre-digestion' teaching (107 sub 1 – N channels into MUX 308) for time-division multiplexing for reduction of downstream apodizer components as detailed in the discussion therein of Fig. 3.

Applicant's attorney is kindly invited to contact the Examiner to attempt resolution irrespective of the stage of prosecution particularly in light of the age of this application.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to FRANCIS JAWORSKI whose telephone number is (571)272-8115. The examiner can normally be reached on weekdays from 11AM to 3PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long V. Le, can be reached on 571-272-0823. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://portal.uspto.gov/external/portal>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/FRANCIS JAWORSKI/

Primary Examiner, Art Unit 3768